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## (54) IMPROVEMENTS IN SACRIFICIAL GALVANIC ANODES

(71) We, A/S SKARPENORD, a Norwegian Body Corporate, of 3970 Langesund, Norway, do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—

The present invention relates to sacrificial galvanic anodes which are used for the electrolytic protection from erosion of metal parts which are located in an electrolyte.

The principle of cathodic protection is well known and is not further discussed herein. However, as examples, the protection of ship's tanks containing sea water as ballast, underwater parts of drilling platforms and underwater pipes for transport of gas and oil from offshore sources, can be mentioned.

Galvanic anodes consist of magnesium, aluminium or zinc, and are cast to a supporting metal part by means of which the anode is suspended or secured to the construction to be protected. The anode material becomes gradually eroded and since it is difficult to predetermine how the erosion will take place, and be distributed over the anode material, it has been a disadvantage of the galvanic anodes known hitherto that an erosion which is stronger on the one side than the other leads to the loosening of the anode material which falls off in large pieces and is not used up and leads to increased cost of the anode, and, furthermore, the construction may not then be adequately protected. If pieces of the anode material fall from a certain height in an empty ship's tank, spark formation can lead to a catastrophe. The same conditions cause problems in regard to the protection of underwater pipes, in that practical and economical difficulties are entailed in the replacement of damaged anodes, particularly when the pipe is at great depth and the anode is intended to last for many years. There can be little control of underwater pipes and the result is that the pipe is subjected to undesirable erosion and the environment is subjected to contamination before the end of the life time of the pipe, all due to the fact that the anode material which would have been active for a long period of time falls from the supporting metal part and is unused.

The conditions can be particularly difficult in regard to underwater pipes, due to continuous movement on the sea bed; such conditions prevail in relatively shallow water and the North Sea shelf area is a typical example. If the sea bed is of sand, there will be travelling sand waves which can contain large stones and the sand waves polish the pipes clean after a relatively short period of time, even though these are protected in all possible known ways by coating with water-tight protective mass and casting in concrete, and galvanic anodes are intended to last the entire lifetime of the pipe, up to twenty years.

Previously known anodes comprise, as mentioned, a supporting metal part and the anode material is cast therearound and, in an attempt to determine how the erosion of the anode material is to take place, an electrically insulating coating material has been applied to one or more of the surfaces of the anode material. Erosion is thereby decreased at the coated portions; however, there is still the risk that erosion may take place in such a manner that large pieces of active anode material fall off and are lost. One of the reasons why the anode material is loosened from the support part on to which it was cast is that the linear contraction of the anode material when it hardens around or on the supporting metal part is greater than that of the metal part, so that stresses or cracks occur with consequential poor adhesion and, during a period of time, this leads to the penetration of the electrolyte, for example, sea water, between the supporting metal part and the anode material. Erosion then takes place here also. In addition to the deterioration of the mechanical connection in this manner, the erosion also affects the electrical contact between the supporting metal part and the material in the anode.

In order to achieve adequate mechanical strength between the anode material and the iron which is to be embedded in the anode material, it has hitherto been necessary to position the iron at a distance from one side

of the anode which can constitute 25% of the thickness of the anode. The part of the anode material which is finally in use beneath the iron can constitute a significant percentage of the material, which is more or less useless, in part due to the screening, in part because the mechanical connection and thereby the electrical connection is so deficient that the remainder of the anode must be considered valueless.

It is an object of the invention to provide a sacrificial galvanic anode where the contraction of the anode material, when it hardens after being cast onto a supporting metal part, does not have serious consequences as previously.

According to the present invention there is provided a sacrificial galvanic anode for cathodic protection comprising a body of anode material cast onto a support member, the support member being secured to one surface of said body, wherein the support member comprises at least one supporting metal part secured to a bonding member which is capable of accompanying contractions of said body of anode material.

The bonding member provides a substantially improved bond between the supporting metal part and the anode material. The connection anode suppport member can thereby be made entirely on one surface of the body of anode material and the entire anode material is then utilized.

In an embodiment, the support member includes an expansible network of metal which, due to its mechanical properties, can accompany the anode material when this contracts during cooling and hardening, without the connection between the expanded metal and the support member being affected.

In a further embodiment the supporting metal part is formed of supporting metal lugs of, for example, flat iron or round iron, which prior to casting are secured to the expansible metal, and project from the anode body to serve for welding or bolting to the construction to be protected.

The present invention will hereinafter be described, by way of example, with reference to the accompanying drawings, in which:—

Figure 1 shows diagrammatically a perspective view of a galvanic anode of trapezoidal cross-section,

Figure 2 shows diagrammatically a perspective view of a further embodiment of a galvanic anode,

Figure 3 shows diagrammatically a perspective view of another embodiment of a galvanic anode in which a supporting metal part covers one surface of a body of anode material,

Figure 4 shows diagrammatically a perspective view of a further embodiment of a galvanic anode having supporting metal lugs, and

Figure 5 shows diagrammatically a perspective view of a still further embodiment of a galvanic anode suitable for the protection of pipes.

Figure 1 shows an elongate sacrifical galvanic anode of trapezoidal cross-section. A body 1 of anode material is cast onto a support member formed of a supporting metal part 2 and an expansible network 3 of metal. The expansible metal 3 is welded to one surface of the metal part 2 which is in the form of a metal plate. The support member 2, 3 is secured to one surface of the body 1 to protect that surface from erosion. The expansible metal 3 is welded to the metal part 2 at points disposed such that the expansible metal 3 can expand and contract to a certain degree together with the body of anode material when this contracts on hardening, without the connection points between the expansible metal 3 and the supporting metal part 2 being affected. The expansible metal 3 acts as a bonding member providing a good bond both mechanically and electrically between the metal part 2 and the body 1 of anode material.

On hardening, the body of anode material contracts in all directions and the expansible metal 3 is cut such that the network extends obliquely to the side edges of the expansible metal, as indicated by lines 4. It is thereby possible for the expansible metal to expand in all directions. In the embodiment of Figure 1, the expansible metal 4 is on the surface of the supporting metal part nearest to the body 1 of anode material. However, there is no reason why the expansible metal should not be disposed on the opposite surface of the metal part, as indicated in Figure 2. Furthermore, in the embodiment of Figure 2 the expansible metal 3 is of a width which is substantially greater than the width of the supporting metal part 2 and is then even more capable of accompanying the contractions of the anode material when this hardens. Also here, the expansible metal is cut such that the network extends obliquely to the side edges of the expansible metal. In certain cases, it may be to advantage to reduce the erosion of the anode material on the surface of the body of anode material which is closest to the support member, and this can be done by means of an electrically insulating coating 5 applied to the lower surface of the anode as indicated in Figure 2.

Another way of protecting one surface of the anode is to allow the supporting metal part 1 to cover one surface of the body 1 of anode material, as illustrated in Figure 3. Here also, the supporting metal part 2 is welded to expansible metal 3 to form a support member having the same properties as described above. Even if electrolyte were to penetrate between the body 1 and the supporting metal part 2, so that erosion occured, the

expansible metal 3 would be so well embedded in the body 1 both in the embodiment of Figure 3 and in the previously described embodiments, that the anode material would be bonded to the expanded metal until it is entirely used up.

A variation of the examples described hitherto is illustrated in Figure 4 in which the anode body 1 is cast onto a support metal formed of supporting metal lugs 2 secured to the expansible metal 3. The lugs 2 can be used to secure the anode to the construction to be protected.

Figure 5 illustrates a special embodiment example which is suitable for the protection of pipes. The supporting metal part 2 is formed as two half-portions of a circle, which ends effected so as to fit one another and capable of being welded together when the anode is fastened around the pipe. As the supporting metal part 2 protects the inside of the body 1 of anode material from erosion, the anode material is entirely consumed by erosion from the exterior of the body of anode material. An expansible network of metal is used as indicated at 3 to provide a good bond both mechanically and electrically between the supporting part 2 and the body 1 of anode material.

The examples shown serve merely to illustrate the invention and form no restriction of the scope of the invention, as for example, in place of the network of expandable metal, stamped tabs and tongues may be used which are bent upwardly from the plane through the supporting metal part. The length of the tongue is then adapted so that, to a reasonable degree, it can accompany the contraction of the anode material when this hardens.

WHAT WE CLAIM IS:—

1. A sacrificial galvanic anode for cathodic protection comprising a body of anode material cast onto a support member, the support member being secured to one surface of said body, wherein the support member comprises at least one supporting metal part secured to a bonding member which is capable of accompanying contractions of said body of anode material.

2. A galvanic anode as claimed in Claim 1, wherein said bonding member comprises an expansible network of metal.

3. A galvanic anode as claimed in Claim 2, wherein said expansible network of metal covers said one surface of the body.

4. A galvanic anode as claimed in Claim 1, 2 or 3, wherein said supporting metal part comprises one or more metal lugs.

5. A galvanic anode as claimed in Claim 1, 2 or 3, wherein said supporting metal part comprises a metal plate.

6. A galvanic anode as claimed in Claim 5, wherein said metal plate covers said one surface of the body.

7. A galvanic anode as claimed in Claim 1, wherein said supporting metal part is a metal plate and said bonding member is formed by tabs or tongues bent from and extending away from the surface of said metal plate.

8. A sacrifical galvanic anode for cathodic protection substantially as hereinbefore described with reference to and as illustrated in Figure 1 of the accompanying drawings.

9. A sacrifical galvanic anode for cathodic protection substantially as hereinbefore described with reference to and as illustrated in Figure 2 of the accompanying drawings.

10. A sacrifical galvanic anode for cathodic protection substantially as hereinbefore described with reference to and as illustrated in Figure 3 of the accompanying drawings.

11. A sacrifical galvanic anode for cathodic protection substantially as hereinbefore described with reference to and as illustrated in Figure 4 of the accompanying drawings.

12. A sacrifical galvanic anode for cathodic protection substantially as hereinbefore described with reference to and as illustrated in Figure 5 of the accompanying drawings.

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FIG. 1

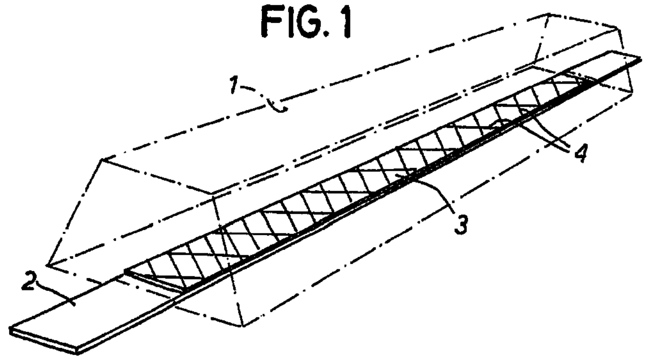


FIG. 2

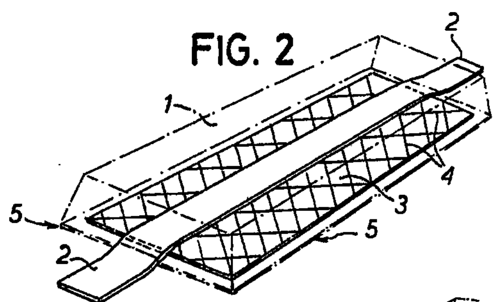


FIG. 3

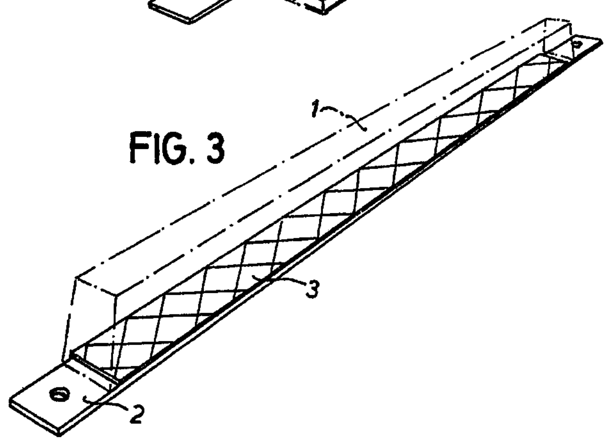

FIG. 4

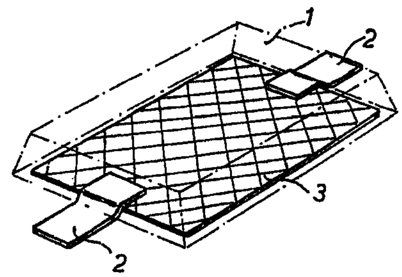


FIG. 5